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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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U.S. Training and Employment Service
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S-69R

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Development of USTES

APTITUDE TEST BATTERY FOR

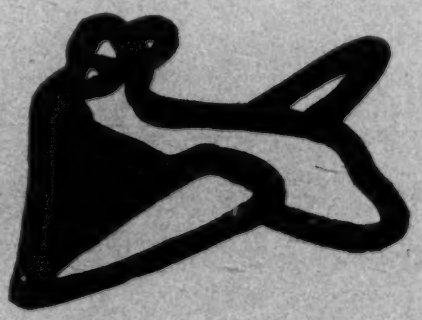
ELECTRICIAN, AIRPLANE

(aircraft mfg.)
825.281

AIRCRAFT MECHANIC, ARMAMENT

(aircraft mfg.)
801.381

U.S. DEPARTMENT OF LABOR
Manpower Administration



ED 001 266

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Electrician, Airplane (aircraft mfg.) 825.281
Aircraft Mechanic, Armament (aircraft mfg.) 801.381

S-69R

(Developed in Cooperation with the
Texas State Employment Service)

U.S. DEPARTMENT OF LABOR
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #835

Development of USTES Aptitude Test Battery

For

Electrician, Airplane (aircraft mfg.) 825.281-026
Aircraft Mechanic, Armament (aircraft mfg.) 801.381-010

S-69R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupations of Electrician, Airplane (aircraft mfg.) 825.281-026, Aircraft Mechanic, Armament (aircraft mfg.) 801.381-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	85
S - Spatial Aptitude	80
K - Motor Coordination	75

RESEARCH SUMMARY

Sample:

51 male workers employed as Electrician, Airplane and AirCraft Mechanic, Armament in Texas. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Broad category supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .54 ($P/2 < .0005$)

Effectiveness of Norms:

Only 69% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 90%

would have been good workers. Thirty-one percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 10% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE I

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	69%	90%
Poor Workers	31%	10%

SAMPLE DESCRIPTION

Size:

N = 51

Occupational Status:

Employed Workers.

Work Setting:

Workers were employed by Consolidated Vultee Aircraft Corporation, Fort Worth, Texas.

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least two years job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	32.7	7.0	22-48	.228
Education (years)	11.1	1.7	8-14	.249
Experience (months)	74.6	30.0	24-120	.060

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1001 were administered in April 1954. The B-1001 scores have been converted to equivalent B-1002 scores.

CRITERION

The criterion consisted of broad category ratings made by foremen; 18 workers were rated good, 17 average, and 16 poor. Quantitative scores corresponding to these qualitative ratings were computed for use in the correlational analysis. These scores are 61, 50, and 39 for ratings of good, average, and poor, respectively.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 31% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 50.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude S which does not have a high correlation with the criterion, was considered for inclusion in the norms because the qualitative analysis indicated that this aptitude might be important for the job duties and the sample had a relatively high mean score for this aptitude. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Appears necessary to learn required electrical theory and operation of various electrical mechanisms (electrical installation); appears necessary to learn operation of mechanical equipment (armament installation).
S - Spatial Aptitude	Appears necessary to relate blueprints and diagrams to solid objects (electrical and armament installation).
P - Form Perception	Appears necessary to perceive pertinent detail in blueprints and diagrams and to make visual comparisons and discriminations when installing equipment (electrical and armament installers).
F - Finger Dexterity	Appears necessary to manipulate bolts, screws, clips, holding devices, and other small objects involved in making assemblies (electrical and armament installation).
M - Manual Dexterity	Appears necessary to use hands effectively in using wrenches, screwdrivers, power drills, and other tools, and in manipulating equipment to be installed (electrical and armament installation).

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=51

	Mean	SD	Range	r
G - General Learning Ability	99.8	17.0	55-133	.34*
V - Verbal Aptitude	96.4	15.2	63-124	.24
N - Numerical Aptitude	96.7	18.3	45-132	.48**
S - Spatial Aptitude	102.7	18.6	63-143	.24
P - Form Perception	92.7	15.4	51-124	.49**
Q - Clerical Perception	87.2	12.6	63-115	.43**
K - Motor Coordination	88.6	18.7	49-132	.48**
F - Finger Dexterity	95.2	17.5	60-133	.33*
M - Manual Dexterity	102.9	21.6	50-164	.42**

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X			X	X
Irrelevant									
Relatively High Mean	X			X					X
Relatively Low Standard Dev.						X			
Significant Correlation with Criterion	X		X		X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G		N	S	P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, N, S, P, Q, K, F, M, at trial cutting scores were able to differentiate between the 69% of the sample considered to be good workers and the 31% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of N-85, S-80, and K-75 provided optimum differentiation for the occupations of Electrician, Airplane (aircraft mfg.) 825.281-026 and Aircraft Mechanic, Armament (aircraft mfg.) 801.381-010. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .54 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
N-85, S-80, and K-75

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	28	35
Poor Workers	13	3	16
Total	20	31	51

Phi Coefficient = .54 Chi Square (X^2_y)=14.8

Significance Level = $P/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-38 which is shown in the 1970 edition, Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .31 is obtained with the OAP-38 norms of N-80, S-85, and K-80.

FACT SHEET

Job Title

Electrician, Airplane (aircraft mfg.) 825.281-026
Aircraft Mechanic, Armament (aircraft mfg.) 801.381-010

Job Summary

(Electrician, Airplane) Installs complete electrical units or their components in an airplane in which the location of electrical control boxes, junction boxes, relays, instrument panels and accessories and the routing of wiring have been predetermined.

(Aircraft Mechanic, Armament) Installs armament and camera equipment and their accessories on production, experimental, modification and engineering aircraft. Refers to operations sheets, blueprints and wiring diagrams to determine procedure and sequence of assembly operations.

Work Performed

(Electrician, Airplane) Installs complete electrical units or their components in an airplane where the location of electrical control boxes, relays, instrument panels and accessories, and the routing of wiring have been predetermined: Studies operations sheets, blueprints, and wiring diagrams to determine sequence of operations and method of installation. Establishes the location of junction boxes, relays, instrument panels and accessories by use of jigs and fixtures, or lays out location working from established reference points, guided by blue-prints, written manufacturing information or verbal instructions, and installs them in airplane attaching with bolts or screws, using wrenches or screwdrivers. Installs pre-assembled wiring harnesses in specified locations working from diagrams, sketches or verbal instructions. Fastens wiring in place with clips, brackets or other holding devices, drilling, reaming and countersinking holes in structural members as required, using electric power drill. Hooks up wiring to equipment, panels, relays and accessories, using wiring diagram and/or identification symbols on wire and terminals as guides. Makes changes in harnesses such as removing, replacing and/or adding wires, including necessary splicing, insulating, tying and installing of terminals, guided by engineering orders attached to blueprints. Makes continuity check on primary installations, using such testing devices as ohmmeter, ammeter, voltmeter, and megger.

(Aircraft Mechanic, Armament) Installs guns, cannon, bombing and camera equipment and their accessories on production, experimental, modification and engineering aircraft: Determines procedure and sequence of assembly operations by referring to operations sheets, blue-prints and wiring diagrams. Installs guns and turrets, camera equipment, and complete bomb release mechanism in assembled airplanes by fitting into preinstalled mounts, drilling and bolting as necessary, using an electric hand drill and such measuring instruments as scales

and combination squares. Drills and reams installation holes, the location of which could not be predetermined, using electric hand drill. Calibrates and adjusts armament, bombing and camera equipment by setting head spacer or ejector travel, bore-sighting fixed guns and aligning cameras. Makes complete disassembly, degreases, cleans, reassembles and functionally checks guns, cannon and their accessories. Installs bomb-release and door-activating mechanism and completes installation of bomb and emergency release mechanisms by threading cables through tubing and adjusting operation of apparatus by turning threaded connections to shorten or extend length of rods. Makes final hook-up of wiring to armament components and power panels, using blueprints and circuit diagrams as guides.

Effectiveness of Norms

Only 69% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the S-69R norms, 90% would have been good workers. Thirty-one percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the S-69R norms, only 10% would have been poor workers.

Applicability of S-69R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.808

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